

SECTION 33 31 00

SANITARY UTILITY SEWERAGE PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Buried Pipe and Fittings.
- B. Cleanouts.
- C. Sewage Ejector.
- D. Field Quality Control.

1.02 RELATED SECTIONS

- A. Section 22 13 01, Sanitary Sewerage
- B. Section 22 14 29, Water Distribution
- C. Section 31 00 00, Earthwork
- D. Section 33 05 16, Utility Structures
- E. Section 33 05 28, Trenching and Backfilling for Utilities

1.03 MEASUREMENT AND PAYMENT

- A. General: Measurement and payment for the site sanitary sewerage system will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for the site sanitary sewerage system indicated in the Bid Schedule of the Bid Form.
- B. Lump Sum: If the Bid Schedule indicates a lump sum for the site sanitary sewerage system, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00, Price and Payment Procedures, under Article entitled "Lump-Sum Measurement".
- C. Unit Price: If the Bid Schedule indicates a unit price for the site sanitary sewerage system, the unit-price method of measurement and payment will be as follows:
 - 1. Measurement:
 - a. Site sanitary sewerage system will be measured for payment by the linear foot of pipe, installed in place and tested, for each type and size, along the centerline of the pipe, with deductions made for manholes or other structures, measured from the inside face of each structure.

- b. Utility structures will be measured separately for payment as specified in Section 33 05 16, Utility Structures.
 - c. Pipe fittings, joints, pipe bedding, cleanouts, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.
 - d. Support of trench excavation, maintenance, support of existing utility facilities, excavation and backfill, concrete, and incidental work pertaining to the installation of sewer pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for sewer pipe.
2. Payment: Site sanitary sewerage system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

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| 1. | ASTM A74 | Standard Specification for Cast Iron Soil Pipe and Fittings |
| 2. | ASTM C14 | Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe |
| 3. | ASTM C76 | Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |
| 4. | ASTM C443 | Standard Specification for Joints for Concrete Pipe and Manholes, using Rubber Gaskets |
| 5. | ASTM C564 | Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings |
| 6. | ASTM D1785 | Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 |
| 7. | ASTM D2466 | Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 40 |
| 8. | ASTM D2564 | Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems |
| 9. | ASTM D2855 | Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings |
| 10. | ASTM D3139 | Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals |
| 11. | ASTM F477 | Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

B. American Water Works Association (AWWA):

1. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch, for Water Transmission and Distribution
2. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

1.05 SUBMITTALS

- A. Refer to Section 01 33 00, Submittal Procedures, and Section 01 33 23, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.
- B. Submit Shop Drawings showing piping layouts, sizes, types, cleanouts, and the sewage structure ejector station.
- C. Submit the respective manufacturers' product data for manufactured materials and equipment.
- D. Submit equipment manufacturer's printed operating and maintenance instructions in accordance with Section 01 78 23, Operation and Maintenance Data, consisting of a detailed parts list, a recommended spare parts list, and complete operation and maintenance procedures.
- E. Submit certified test reports of equipment, as applicable.

1.06 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01 77 00, Closeout Procedures, and Section 01 78 39, Project Record Documents, for submittal requirements and procedures.
- B. Record actual location of piping mains, valves, connections, thrust restraints, and invert elevations.

1.07 SITE CONDITIONS

- A. Excavations shall be dry immediately before and after products are installed. Provide surfaces and structures to, and on which sewerage products will be installed.
- B. Coordinate the installation of the sanitary sewerage system with the jurisdictional sanitary district or utility owner.

PART 2 – PRODUCTS**2.01 BURIED PIPE AND FITTINGS**

- A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated and required. Pipe ends shall be bell and spigot, except plain end pipe shall be joined with mechanical clamp and gasket joint.
- B. PVC Pipe and Fittings, 3 Inches and Smaller:
 - 1. Pipe: Polyvinyl chloride (PVC), conforming with ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1, bell and spigot style solvent sealed jointed.
 - 2. Fittings: ASTM D2466, Socket Weld, same material and schedule as pipe.
 - 3. Joints: Socket welded with PVC solvent cement conforming with ASTM D2564 and ASTM D2855.
- C. PVC Pipe and Fittings, 4 Inches and Larger:
 - 1. Pipe: AWWA C900, Class 200, Poly (Vinyl Chloride) (PVC) Water Pipe with Bell and Spigot Ends and Flexible Ring Joints.
 - 2. Fittings: ASTM D2466, Type 1, Grade 1, Poly (Vinyl Chloride) (PVC) Fittings, Class 200.
 - 3. Joints: ASTM D3139 gasketed bell joints with ASTM F477 gaskets.
- D. Cast Iron Soil Pipe:
 - 1. Pipe: ASTM A74.
 - 2. Joint Devices: ASTM C564 or AWWA C111/A.21.11, rubber gasket joint devices, as applicable.
- E. Concrete Pipe:
 - 1. ASTM C14, Class 3, unreinforced.
 - 2. Joint Device: ASTM C443, rubber compression gasket joint.
- F. Reinforced Concrete Pipe:
 - 1. Pipe: ASTM C76, Class III, with steel reinforcement.
 - 2. Joint Device: ASTM C443, rubber compression gasket joint.
- G. Pipe Accessories:

1. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, with neoprene ribbed gasket for positive seal.
 2. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers traps, and other configurations as indicated or required.
- H. Pipe Bedding Material: Clean sand as specified in Section 33 05 28, Trenching and Backfilling for Utilities.

2.02 CLEANOUTS

- A. At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with countersunk slot, and cast iron frame and cover.

2.03 TRACER WIRE

- A. Stranded copper AWG No. 10 with U.S.E. rated insulation. Color: Black.
- B. Reflective Warning Tape.

2.04 SEWAGE EJECTOR

- A. Provide in accordance with applicable requirements of Section 22 14 29, Sump Pumps.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated.

3.02 PREPARATION

- A. Excavations shall be free of water and extraneous material immediately before sanitary sewerage products are installed or placed. Bottoms of trenches shall have a 6 inch sand bed and shall be formed to support the bottom quadrant of the pipe and fittings. Should rock be encountered or should bedding material be unsuitable to support the products at design elevation, continue excavation to an elevation 8 inches below the design elevation and backfill with clean sand.
- B. Hand trim excavations to required elevation.
- C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling and compacting operations.

- D. Interior of pipe, pipe fittings, valves, drains, and cleanouts shall be cleaned of foreign substances before installation.

3.03 INSTALLATION REQUIREMENTS

- A. Excavate pipe trench in accordance with Section 33 05 28, Trenching and Backfilling for Utilities. Hand-trim bottom of trench to approximately 6 inches below invert of pipe.
- B. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.
- C. Place sand bedding material meeting the requirements of Section 33 05 28, Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.
- D. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.
- E. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28, Trenching and Backfilling for Utilities.
- F. Maintain optimum moisture content of bedding material to attain required compaction density.
- G. Install products where indicated. Remove and reinstall products that are disturbed after installation. Ends of products to which future connections will be made shall be either valved, or properly plugged, capped, and anchored.
- H. Connections to existing facilities shall be made with fittings and short bends to suit the actual conditions. Connect products in accordance with the product manufacturer's installation instructions.
- I. Pipe and fittings shall be set to line and grade before joints are made up. Angular deflections of joints shall not exceed the recommendations of the pipe and fitting manufacturer. Should the alignment require deflection of joints to be in excess of those recommended, use special bends to achieve the indicated deflection. Pipe ends and joints shall be prepared in accordance with the manufacturer's recommendations. As a minimum, pipe ends shall be sanded and cleaned, fittings shall be cleaned, and solvent shall be applied to both pipe and fittings.
- J. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321, and the manufacturer's instructions. Seal joints water tight.
- K. Lay pipe to slope gradients as indicated.
- L. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches, compacted to 95 percent relative density.

3.04 INSTALLING PIPE

- A. Protect pipe and fittings during handling to prevent damage.
- B. Place, shape, and compact bedding material to receive barrel of pipe.
- C. Start laying pipe at the lowest point; lay true to line and grade indicated.
- D. Install pipe to bear on bedding material along its entire length.
- E. Do not place the pipe on blocking material of any type.
- F. Do not use wedges while installing the pipe.
- G. Install pipe so that bells and grooves are on the upstream end.
- H. Align each section of pipe with adjoining section leaving a uniform annular space between the bell and spigot to prevent sudden offsets in flow line.
- I. As each section of pipe is laid, place sufficient bedding and backfill to hold it firmly in place.
- J. Apply lubricant to rubber gasket (O-rings) immediately before joining pipe sections.
- K. Keep interior of sewer clean as work progresses. Where small pipe sizes make cleaning difficult, keep a suitable swab and pulling line in the pipe, and pull through each joint immediately after jointing is completed.
- L. Keep trenches and excavations dry and free of water during construction and until backfilling and compaction are completed.
- M. When work is not in progress, securely plug ends of pipe and fittings to prevent extraneous matter from entering pipes and fittings.
- N. Cut pipe ends, which project into a sewer structure, flush with the inside face of the structure and cover exposed pipe reinforcement with grout.
- O. Where length of stub is not indicated, install a 4 foot length, and seal the free end with brick masonry bulkhead or an approved stopper.
- P. Obtain the Engineer's approval before covering pipe.
- Q. Where indicated, place additional bedding material around and over the pipe in lifts not exceeding 6 inches before compaction. Compact each lift before placement of the next lift.
- R. Accomplish compaction by methods that will avoid damage to pipe and will not disturb its alignment and grade. The use of vibratory rollers is prohibited until compacted cover over pipe has reached 3 feet or half the pipe diameter; whichever is greater.

- S. Connect sanitary sewerage system to existing public sanitary sewers in accordance with requirements of the jurisdictional authority.

3.05 PIPE CLEANOUTS

- A. Installation: Cleanouts shall be the same size as the pipe, with 4 inch diameter as a minimum. Cleanouts for drainage pipe shall consist of a longswep 1/4 bend, or one or two 1/8 bends extended to the location indicated. Wall or accessible piping cleanouts shall be T-pattern, 90 degree branch drainage fittings having screw plugs. Cleanouts shall be provided at the base of each riser and shall consist of a wye pattern fitting with a screw plug.
- B. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.
- C. Establish elevations and invert for inlets and outlets.
- D. Mount cleanout surface hub level in grout to elevation indicated.

3.06 TRACER WIRE

- A. Tracer Wire: Install tracer wire with reflective warning tape. Wire shall be accessible For tracing at all cleanout locations.

3.07 FIELD QUALITY CONTROL

- A. Requirements:
 1. Refer to Section 01 45 00, Quality Control, for field inspection and testing requirements.
 2. Where drainage piping is located below invert slabs, conduct a ball, shuttlecock, or mandrel test to ensure that the line is free of obstructions subsequent to the placing of pervious backfill material over the line and prior to the placement of the concrete invert slab.
 3. Upon completion of the test and determination that the line is free of obstructions, plug, cap, or otherwise close the open end or ends of the installed piping to prevent the entrance of debris into the lines.
 4. Immediately prior to final inspection of the work, remove debris from manholes, drain inlets, and floor scupper drains. In the presence of the jurisdictional sanitary utility owner's representative, prove by one of the methods specified above that the piping is free of obstructions.
 5. The Contractor shall be responsible for making all necessary arrangements with the jurisdictional sanitary utility owner for performing and witnessing the required tests.
 6. Request inspection of exposed piping prior to placing backfill.

7. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00, Earthwork.
8. If tests indicate work does not meet requirements, remove such work, replace, and retest at no additional cost to the District.

B. Sanitary Pipeline Tests:

1. Perform air tests on all installed sanitary sewer pipes upon completion of backfill.
2. Hydrostatically test all installed sanitary sewer force mains.
3. Test all manholes for infiltration or exfiltration.
4. Test pipe sections by the exfiltration test.
5. Test sewer 24 inches or less in diameter with low pressure.
6. Sewers with a diameter greater than 24 inches may be tested by visual inspection.

C. Exfiltration Test:

1. Tightly plug end of pipe at downstream manhole.
2. Fill sewer, at either upstream manhole or standpipe, with water.
3. Allow water to stand for not less than eight hours, and until pipe has become saturated. Refill manhole or pipe to measuring mark, and begin test.
4. Exfiltration will be determined as follows:
 - a. If standpipe has been filled, maintain a head of water not less than 2 feet nor more than 15 feet above highest point in the line being tested.
 - 1) Exfiltration: that volume of water added to standpipe during a 20 hour period.
 - b. If upstream manhole has been filled, measure original water elevation and, after 20 hours, final water elevation. Convert difference in elevation to gallons. Head of water shall be not less than 2 feet above highest point in the line being tested or not less than 2 feet above existing groundwater table, whichever is greater.
 - 1) Exfiltration: that volume of water calculated from the difference in elevations during a 20 hour period.
5. Allowable leakage:
 - a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.
 - b. If leakage exceeds permissible loss, sewer section will not be accepted.

- c. Do not conduct another exfiltration test until conditions of groundwater surrounding pipe return to a condition similar to those existing at beginning of test period.

D. Infiltration Test:

1. Tightly plug end of pipe at upstream manhole.
2. Install a 90 degree notch weir in downstream manhole.
3. Allow water to accumulate behind weir until overflow is constant.
4. Allowable leakage:
 - a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.
 - b. If measured infiltration is more than the allowable rate, sewer section will not be accepted.

E. Low-Pressure Air Test:

1. Clean and set sections of pipe to be tested before starting air test.
2. Plug pipe outlets with pneumatic plugs capable of resisting internal testing pressures without requiring external bracing.
3. Immediately following pipe cleaning and wetting, slowly supply air to plugged pipe until internal air pressure reaches 4 psi. Allow at least two minutes for temperature to stabilize before proceeding, except slowly add air to maintain a 3.5 psig to 4 psig pressure. While temperature is stabilizing, spray plugs, pipes, and hoses with soap solution and eliminate air leaks.
4. After temperature has stabilized, measure time required for pressure to drop from 3.5 psig to 2.5 psig. If measured time exceeds allowable time, pipe will not be accepted.
5. Time, in seconds, for pressure to drop from 3.5 to 2.5 psig shall be not less than the following; time for intermediate lengths shall be interpolated:

Length of Pipe (Ft)	Pipe Diameter In Inches						
	8	10	12	15	18	21	24
25	18	28	40	62	89	121	158
50	35	55	79	126	178	243	317
75	53	83	119	186	267	364	475
100	70	110	158	248	356	485	634
125	83	138	198	309	444	595	680
150	100	165	238	375	510	595	680
175	123	193	277	425	510	595	680
200	141	220	317	425	510	595	680
225	158	248	340	425	510	595	680
250	176	275	340	425	510	595	680
275	194	283	340	425	510	595	680

Length of Pipe (Ft)	Pipe Diameter In Inches						
	8	10	12	15	18	21	24
300	211	283	340	425	510	595	680
350	227	283	340	425	510	595	680
400	227	283	340	425	510	595	680

- F. Visual Test Method: Slowly pull a television camera through sewer and inspect for visual leaks and cracks in pipe. Repair leaks, then re-inspect pipe.
- G. Joint Pressure Testing:
1. Insert sealing packer with joint testing capability, into sewer line.
 2. Place sealing packer around joint and pressure test joint. If a drop in air pressure occurs, reseal the joint.
 3. Repeat procedure for each joint.
- H. Criteria for Acceptance: The section of sewer being tested will not be accepted if test results exceed allowable leakage or take less time than minimum holding time. If pipe proves to be unacceptable, immediately repair defective materials and installation. The Contractor will not be permitted to change to another test if original test method reveals system has failed.
- I. Obstruction Tests:
1. Perform field tests to verify that installed sanitary systems are free from obstructions.
 2. Remove obstructions by excavating at the apparent obstruction and repairing or replacing the defective pipe.

END OF SECTION 33 31 00